
Electron Cooling Instrumentation

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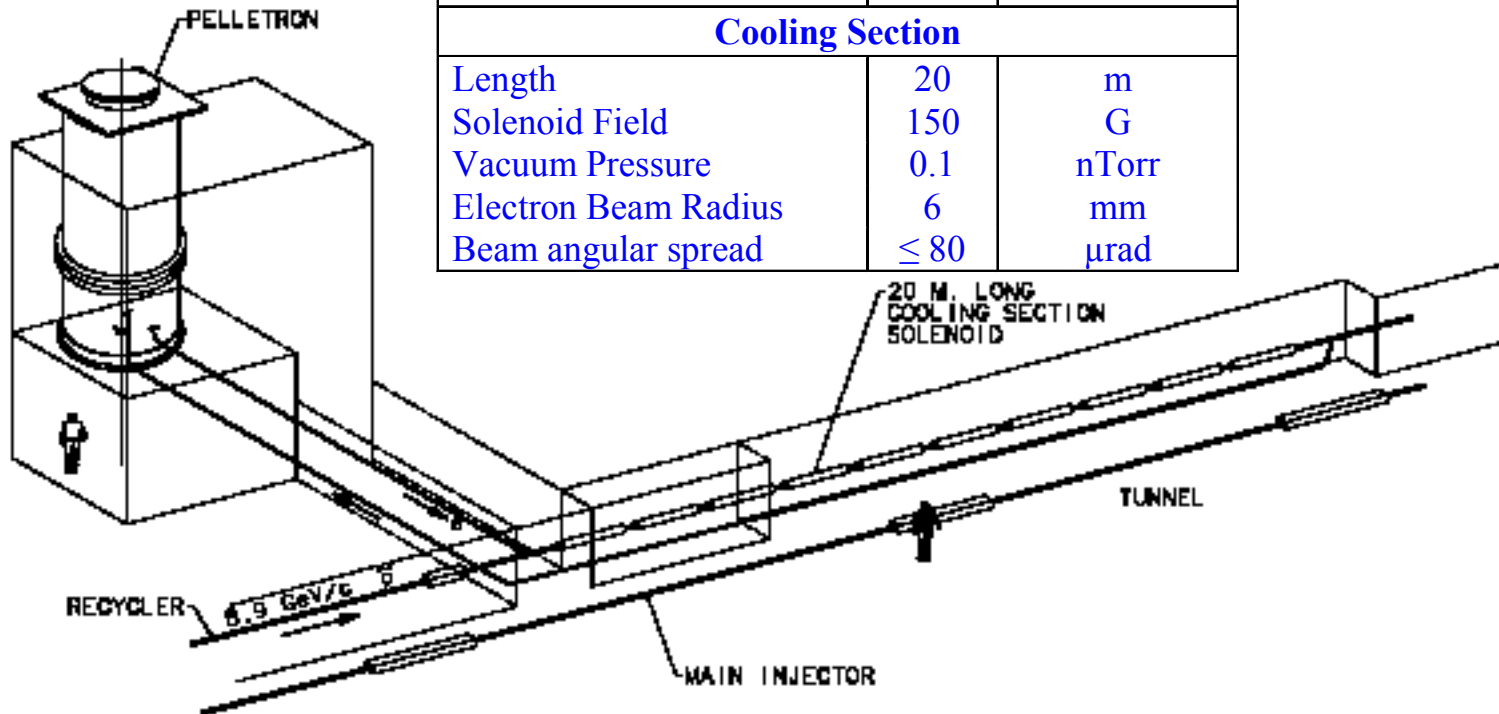
DoE review

July 21, 2003

Schematic Layout of the Recycler Electron Cooling

Electron Cooling System Parameters

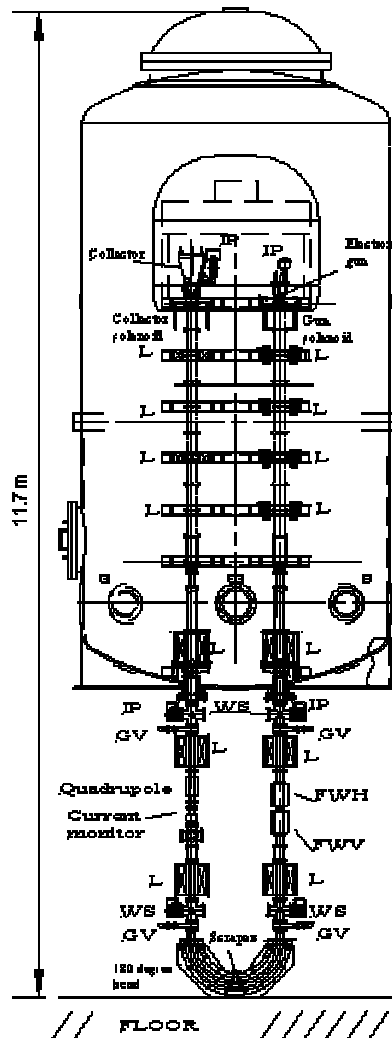
| Parameter | Value | Units |
|----------------------------------|-----------|-----------------|
| Electrostatic Accelerator | | |
| Terminal Voltage | 4.3 | MV |
| Electron Beam Current | 0.5 | A |
| Terminal Voltage Ripple | 500 | V (FWHM) |
| Cathode Radius | 2.5 | mm |
| Gun Solenoid Field | 600 | G |
| Cooling Section | | |
| Length | 20 | m |
| Solenoid Field | 150 | G |
| Vacuum Pressure | 0.1 | nTorr |
| Electron Beam Radius | 6 | mm |
| Beam angular spread | ≤ 80 | μrad |



Recirculation experiment at WideBand

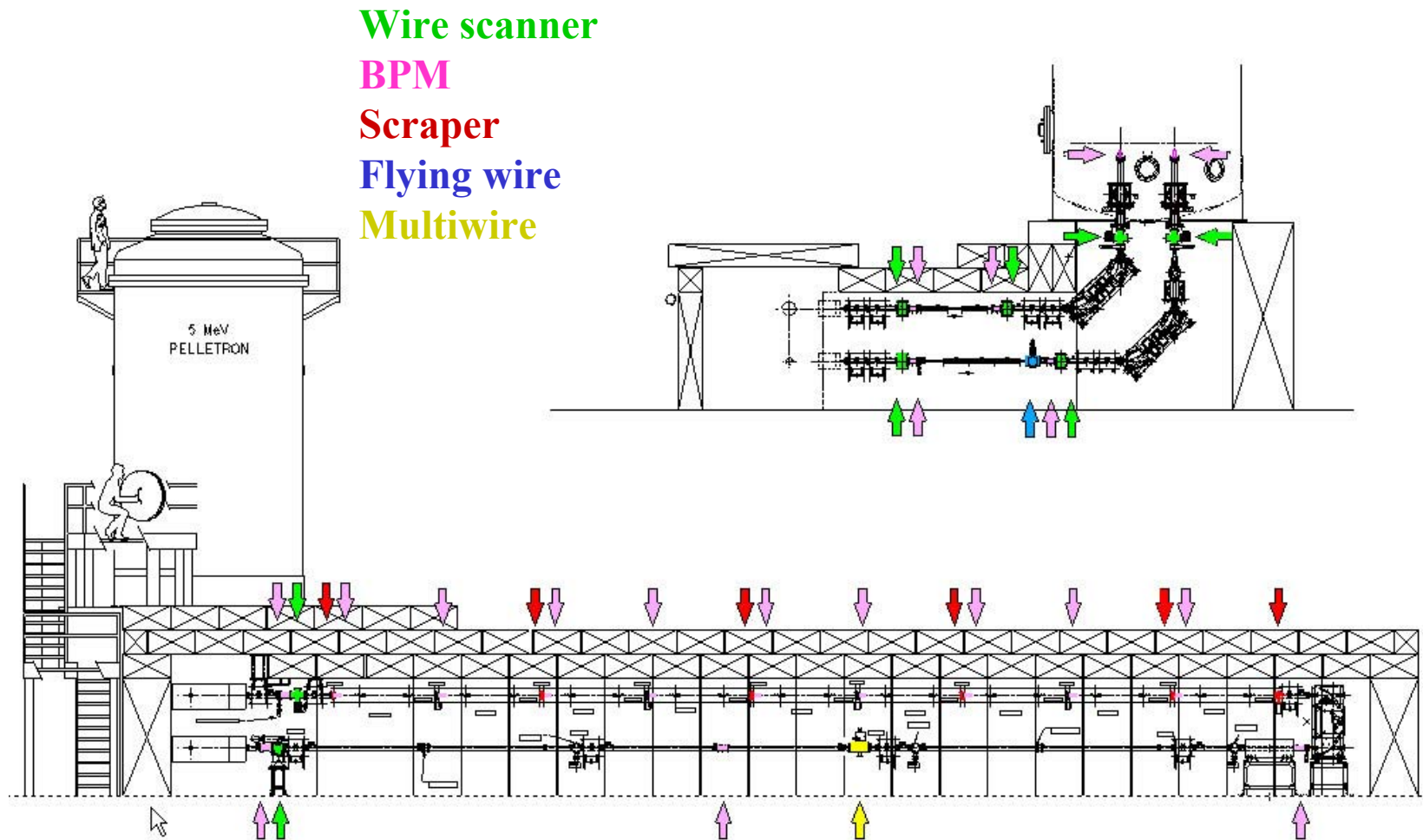
Operation with beam: Mar 01- Nov 02

Instrumentation used in experiment



| Type | Comments |
|--------------------------------------------------------------------|------------------------------------------------------------|
| Controls of DC voltages and currents of all PSS in Pelletron | Reliable operation; no changes for full length set-up |
| μ s-scale measurements of cathode current and terminal voltage | Same |
| Wire scanners | Same |
| BPMs | 50 μ m resolution for DC beam; need to add pulsed mode |
| Scrapers | Need improvements |
| Flying wire | Operational. Need to switch to ACNET |

Diagnostics in the ECOOL beamline



List of beam diagnostics tools

| Type, quantity | Description | Operating mode | Used for |
|---------------------|-------------------------------------------------------|------------------------------------------------------|--------------------------------------------------------------------------|
| Wire scanner 8 | Rotating 1 mm wire | DC, 0.1- 3 μ A | Initial alignment; quick tests of beam line status |
| BPM 19 | Capacitive pickups | DC with current modulation; 2 μ s, 1 Hz pulse | Electron beam position measurements; in MI31 used for pbars as well |
| Scraper 5 | Copper plate with 15 mm round opening | DC, full current | Measurements of beam size at the level of 10^{-5} of the total current |
| Flying wire 1 | 25 μ m carbon wire flying at 5 m/s | DC, full current | Beam size and density distribution measurements |
| Multiwire harp 1 | tungsten, 25 μ m wires over 0.5 mm; 50 each plane | 2 μ s , 1 Hz pulse | Beam size and density distribution measurements |

List of beam diagnostics tools (cont.)

| Type | Resolution | Control | Status |
|----------------|----------------------------------|---------|--------------------------------------------|
| Wire scanner | 1 mm | Analog | Fully operational |
| BPM | 50 μm in all modes | ACNET | Tested in pulsed mode Tested with pbars |
| Scraper | 50 μm | ACNET | Under commissioning |
| Flying wire | 50 μm | ACNET | Tested (with a PC control) |
| Multiwire harp | 0.5 mm | ACNET | Under commissioning |

Conclusion

- All instrumentation necessary for commissioning of the full length beam line is installed
- All tools have been tested, and most of them are operational
- Instrumentation intended for routine operation is controlled by ACNET
- All these elements of diagnostics will be used in Recycler. A small addition will be made to take into account longer cooling section and longer beam lines